

## Rocky Flats Environmental Technology Site

MAN-077-DDCP

## THE D&amp;D CHARACTERIZATION PROTOCOL

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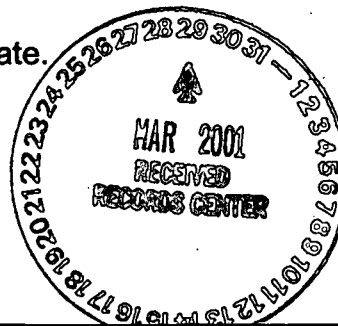
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## EXECUTIVE SUMMARY

Kaiser-Hill Company, L.L.C. (K-H), the U.S. Department of Energy/Rocky Flats Field Office (DOE/RFFO), the Colorado Department of Public Health and Environment (CDPHE), and the U.S. Environmental Protection Agency (EPA) agree that building and facility characterization needs to be consistent when applied throughout the decommissioning program. To support this effort, the EPA Data Quality Objectives (DQO) process will be applied to the characterization process across the Special Nuclear Materials (SNM) Consolidation, and Deactivation, Decontamination and Decommissioning (D&D) Program.

This Rocky Flats Environmental Technology Site (RFETS or Site) D&D Characterization Protocol provides an overview of the characterization process, the requirements, and general guidance that **SHALL** be implemented when conducting characterizations within Type 1, 2 and 3 facilities. The NUREG 1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), issued in December 1997, and this document describe the key D&D characterization phases; describe the DQOs for the various phases; and present the independent verification and validation, quality assurance and data review requirements. This document is to be used in conjunction with the Facility Disposition Program Manual; and the Site-Wide Reconnaissance Level Characterization and Pre-Demolition Survey Plans when preparing project-specific characterization reports to comply with the Rocky Flats Cleanup Agreement (RFCA).

## ABBREVIATIONS/ACRONYMS

ACM	Asbestos-containing material
ASME	American Society Mechanical Engineers
CBDPP	Chronic Beryllium Disease Prevention Program
CCR	Code of Colorado Regulations
CDPHE	Colorado Department of Public Health and the Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHWA	Colorado Hazardous Waste Act
CFR	Code of Federal Regulations
D&D	Decontamination and Decommissioning
DCGL	Derived Concentration Guideline Level
DDCP	D&D Characterization Protocol
DER	Duplicate Error Ratio
DOE	U.S. Department of Energy
DOP	Decommissioning Operations Plan
DPP	Decommissioning Program Plan
DQA	Data Quality Assessment
DQO	Data Quality Objectives
EDD	Electronic Data Deliverable
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
FDPM	Facility Disposition Program Manual
HASP	Health and Safety Plan
HRR	Historical Release Report
HSA	Historical Site Assessment
IM/IRA	Interim Measure/Interim Remedial Action
IPC	In-Process Characterization
ISM	Integrated Safety Management
IWCP	Integrated Work Control Program
K-H	Kaiser-Hill Company, L.L.C.
LCSD	Laboratory Control Sample Duplicates
LLMW	Low-Level Mixed Waste
LLW	Low-Level Waste
LRA	Lead Regulatory Agency
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
NIST	National Institute of Standards and Technology
NRA	No Radioactivity Added
NVLAP	National Voluntary Laboratory Accreditation Program
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PATS	Plant Action Tracking System
PCB	Polychlorinated Biphenyl/PDS

## ABBREVIATIONS/ACRONYMS (Continued)

PDS	Pre-Demolition Survey
PDSP	Pre-Demolition Survey Plan
PDSR	Pre-Demolition Survey Report
PE	Performance Evaluation
PQL	Practical Quantitation Limit
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPJP	Quality Assurance Project Plan
QAP	Quality Assurance Program
QC	Quality Control
RBE	Radiological Building Engineer
RCM	Radiological Control Manual
RCRA	Resource Conservation and Recovery Act
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
FFFO	Rocky Flats Field Office
RIRs	Radiological Improvement Reports
RLC	Reconnaissance Level Characterization
RLCP	Reconnaissance Level Characterization Plan
RLCR	Reconnaissance Level Characterization Report
RPD	Relative Percent Difference
RSP	Radiological Safety Practices
SAP	Sampling and Analysis Plan
SNM	Special Nuclear Materials
SOP	Standard Operating Procedure
SOW	Statement of Work
TRU	Transuranic
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage, and Disposal Facility
UCL	Upper Confidence Level
V&V	Verification and Validation
WAC	Waste Acceptance Criteria
WSRIC	Waste Stream Residue Identification and Characterization

## 1.0 INTRODUCTION

The Rocky Flats Cleanup Agreement (RFCA, July 1996) establishes the regulatory framework for cleanup and closure of the Rocky Flats Environmental Technology Site (RFETS). Facility disposition is an integral part of RFCA that requires the development and implementation of a facility characterization program at RFETS. Facility characterization is the process of identifying the physical, chemical, and radiological hazards associated with a building or building cluster. Information gathered during characterization will be used to support facility disposition, including selection of decommissioning alternatives and the development of project-specific documentation.

### 1.1 APPLICABILITY AND USE

This Protocol applies to all Site employees and subcontractors performing facility characterization across the SNM Consolidation, Deactivation, Decontamination and Decommissioning Program. All organizations conducting SNM consolidation, deactivation, decontamination and decommissioning activities **SHALL** comply with the requirements in this Protocol, including implementation of the EPA Data Quality Objectives (DQO) process to determine and interpret characterization needs. Any changes or revisions to this Protocol **SHALL** be approved by the Kaiser-Hill Company, L.L.C. (K-H), Manager for Decontamination and Decommissioning (D&D) Program Office and the DOE. Major revisions will be transmitted to CDPHE and EPA Region VIII for concurrence.

This Protocol identifies mandatory elements and requirements by using the word "**SHALL**." Additionally, the Protocol uses the word "**Should**" to indicate a recommendation that is based on standards and good business practices. The word "**may**" is used when permission is granted rather than constituted as a requirement.

### 1.2 PURPOSE AND OBJECTIVE

The purpose of this D&D Characterization Protocol (DCPP) is to provide the framework for facility characterization, which provides the data to evaluate the radiological, chemical and physical hazards associated with facilities, classify decommissioning waste streams, and define management options for facility disposition.

The objective is to provide direction for a compliant, consistent and systematic approach to characterizing hazards and classifying waste streams associated with facilities at the RFETS. Identified hazards will be used to establish controls for the protection of RFETS workers, the public and the environment.

### 1.3 SCOPE OF THIS DOCUMENT

This Protocol provides an overview of the characterization process, the requirements, and general guidance for characterizing facilities when developing D&D alternatives for

Type 1, 2 and 3 facilities, as defined in the approved Decommissioning Program Plan (DPP). The process includes the following characterization phases:

- Scoping characterization;
- Reconnaissance Level Characterization (RLC);
- In-Process Characterization (IPC);
- Pre-Demolition Survey (PDS); and
- Post-Demolition Survey.

Details on implementing characterization requirements are provided in the following documents:

- Appendix C of this Protocol for DQOs for In-Process Characterization (IPC);
- Appendix D of this Protocol for Site-Wide Reconnaissance Level Characterization (RLC); and
- Site-Wide Pre-Demolition Survey Plan (PDSP).

Characterization **SHALL** be accomplished through the implementation of this program, which is aligned with the Environmental Protection Agency (EPA) Data Quality Objectives (DQO) process, and the application of approved and accepted characterization practices and methods.

This Protocol was developed to be consistent with the references cited in Section 9.

#### 1.4 FACILITY CHARACTERIZATION DOCUMENT ROADMAP

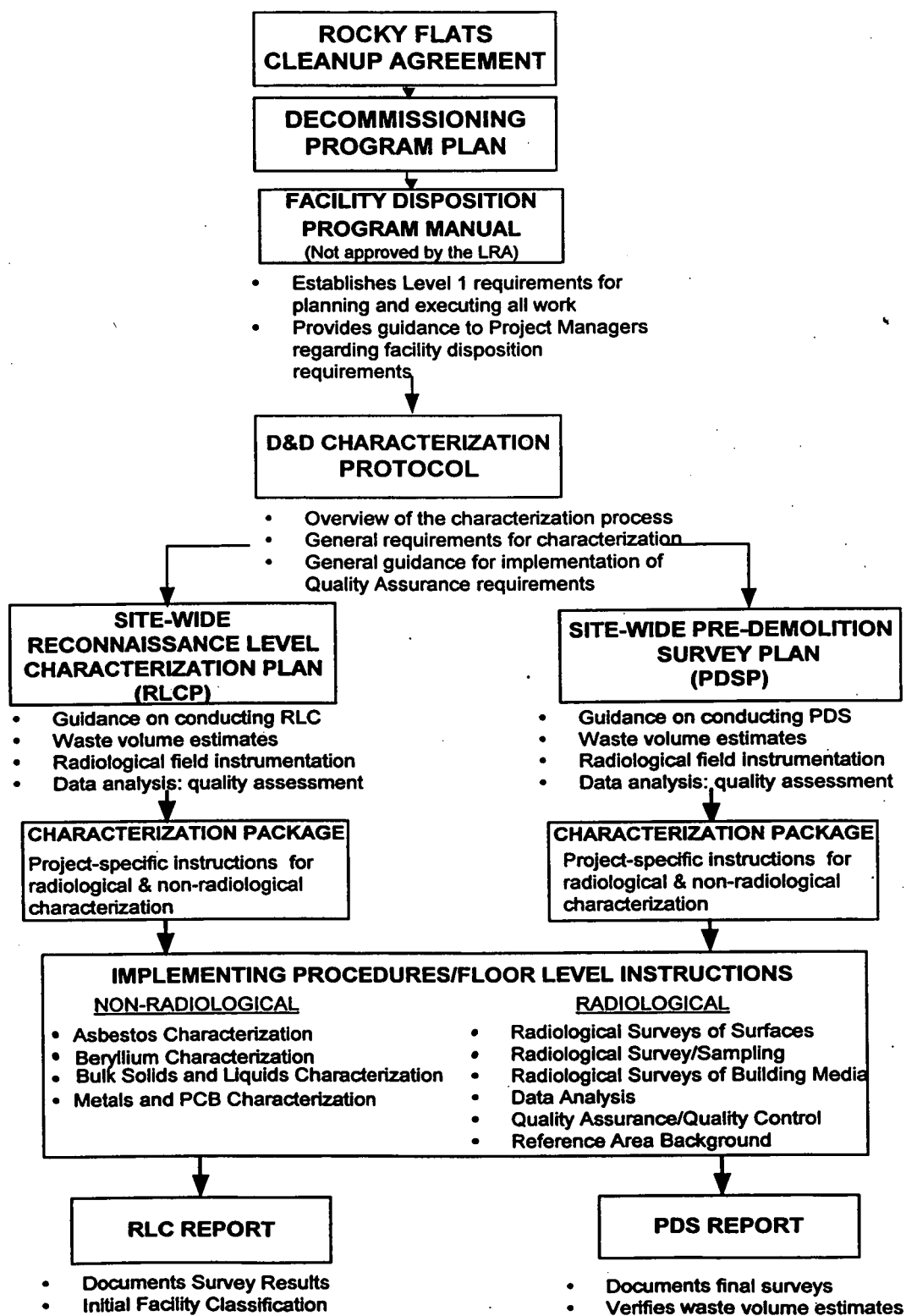
The Facility Disposition Program Manual (FDPM) establishes the RFETS requirements for planning and executing the facility disposition process. (This Manual is an internal Kaiser Hill Program Manual used by Project Managers as a guide in planning for facility disposition. This Manual is not approved by the LRA.) Facility characterization is conducted at the onset of a project, during strip-out and removal of equipment and prior to demolition in order to assess the potential for contamination and to determine the unknowns. This Protocol provides the requirements and guidance for conducting facility characterization as described in Figure 1.1. In addition, there are two plans written in accordance with this Protocol which address the types of characterization conducted. These Plans are the Site-Wide Reconnaissance Level Characterization Plan (RLCP), implemented during the Phase I Planning of a project, and the Site-Wide Pre-Demolition Survey Plan (PDSP), implemented prior to facility demolition. The data and reports resulting from these activities **SHALL** be documented in the RLC and the PDS Reports. These reports **SHALL** be included in the project-specific administrative record file.

Instructions for implementing RLC, IPC and PDS on a project-specific basis **SHALL** be documented in project-specific characterization packages. These packages provide specific survey, scan and sampling instructions, including number and location of surveys, scans and media samples. In addition, Technical Procedures/Floor

Instructions have been written to address how specific radiological and non-radiological constituents are to be characterized. During facility characterization, the instructions included in the characterization package and these procedures **SHALL** be followed per Figure 1.1.

In addition to the characterization procedures, the RFETS procedures and programs that control work **SHALL** be implemented. Primarily, the Integrated Work Control Program (IWCP) is used to control work and ensure that site procedures and programs are incorporated into all phases of characterization. An IWCP package **SHALL** be developed for each characterization phase. The package **SHALL** include project-specific activities and steps, activity-specific controls, and approvals. Characterization packages **SHALL** be included in the IWCP packages. These IWCP packages will ensure that work is conducted in a manner safe to the worker and environment. Refer to the IWCP to ensure that all characterization is planned and conducted in accordance with the IWCP Manual. Section 7.4 of this manual provides additional detail on work control processes.

**FIGURE 1.1 FACILITY CHARACTERIZATION REQUIREMENTS AND GUIDANCE**



## 2.0 OVERVIEW OF THE CHARACTERIZATION PROCESS

Characterization is the process of identifying the chemical and radiological hazards associated with a facility. The following five characterization phases are used:

1. Scoping Characterization;
2. Reconnaissance Level Characterization (RLC);
3. In-Process Characterization (IPC);
4. Pre-Demolition Survey (PDS); and
5. Post-Demolition Survey, as required.

This section presents an overview of the first four phases. Post-demolition surveys are not discussed because 1) very few, if any, post-demolition surveys will be needed, and 2) if one is required, a project-specific characterization package will likely be required.

Through the characterization process, each RFETS facility is "classified or typed" based on the level of potential or existing radiological and/or hazardous substance contamination. The DPP identifies three "types" of facilities:

- **Type 1** facilities are considered "free of contamination."
- **Type 2** facilities are without significant contamination or hazards, but in need of decontamination.
- **Type 3** facilities have significant contamination and/or hazards.

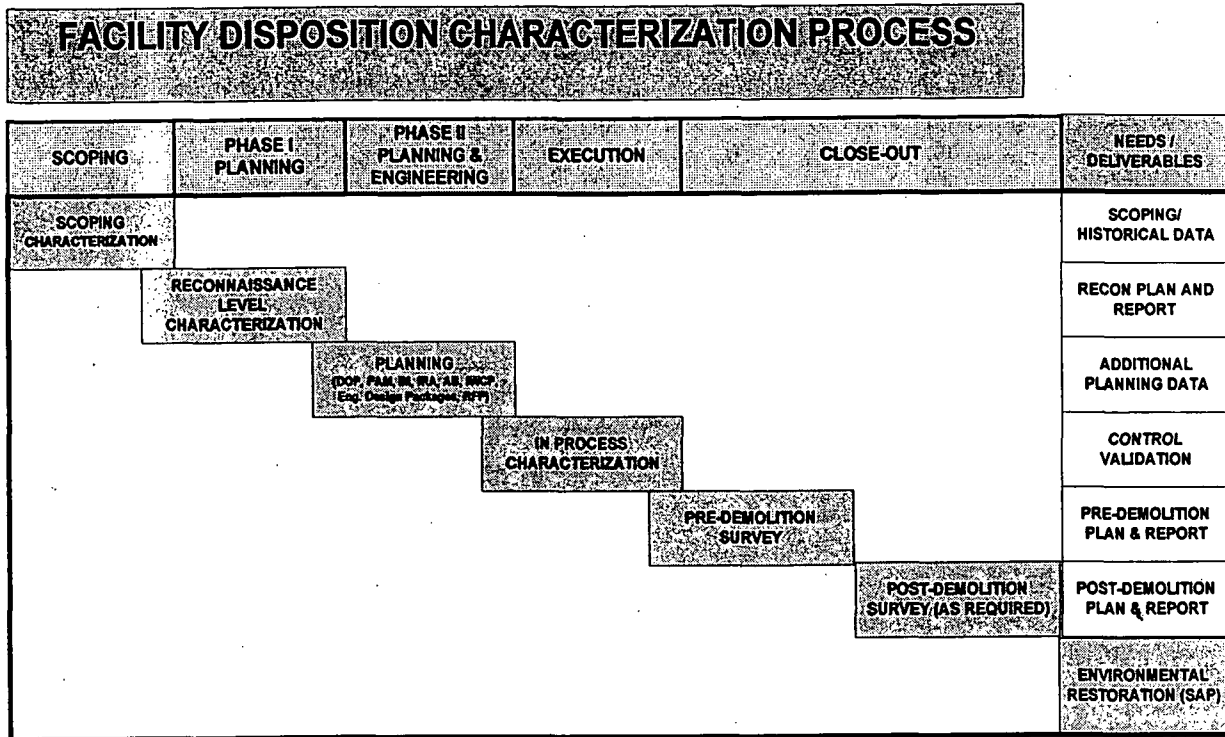
Appendix A provides a graphic presentation of the RFETS Characterization Process. Appendix B contains a logic diagram for determination of facility "type" and relation to the RFETS Characterization Process and development of documents. Figure 2.1 summarizes the five phases of the characterization process. In addition, the following subsections contain discussion of each phase of the characterization process.

Some terms used in this document are used in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM; NUREG 1575). Other terms are not used in MARSSIM but are equivalent to MARSSIM terms. Some key terms and their MARSSIM equivalents are presented below.

- |   |  |
|---|--|
| • Type 1 Facility                       | Class 3 Facility                       |
| • Type 2 Facility                       | Class 2 Facility                       |
| • Type 3 Facility                       | Class 1 Facility                       |
| • Reconnaissance Level Characterization | Scoping Survey/Characterization Survey |
| • In-Process Characterization           | Remedial Action Support Survey         |
| • Pre-Demolition Survey                 | Final Status Survey                    |

A glossary of other key terms is presented in Section 11 of the RLCP (Appendix D).

**FIGURE 2.1 FACILITY DISPOSITION CHARACTERIZATION PROCESS**



## 2.1 SCOPING CHARACTERIZATION

The Scoping Characterization phase establishes the initial project scope and anticipated facility "type". The project scope includes identifying the physical boundaries of the areas to be characterized. The boundaries may include a cluster of related buildings, a single building, or a room/area within a building. Establishment of the facility type requires information regarding building hazards, including physical, chemical and radiological hazards.

The Historical Site Assessment (HSA) is an important component of scoping because it consolidates the existing facility historical information. The HSA **SHALL** include the following minimum information:

- Identification of the potential, likely, or known sources of contamination, including history and nature of material/substance storage, use, spills, and waste handling;
- Inventory of material types and volume estimates;
- A preliminary assessment of contaminant migration;
- Information that may be useful in other characterization phases; and
- A recommendation on whether and what type of further action is warranted (e.g., characterization, decontamination, special handling).

Scoping provides a basis for preliminary evaluations of decommissioning efforts and aids in identifying the need for more extensive RLC and IPC surveys. The result of this

analysis will provide the information necessary to determine an initial facility "type" or a modification to the type. Results of the scoping characterization **SHALL** be incorporated into the RLC Report (RLCR).

Data used for scoping characterization **SHALL** be qualified relative to their use and purpose within the characterization planning effort. The "data" of interest include historical and current data, as applicable. Adequacy and limitations of the data **SHALL** be documented in the RLCR. Data quality **SHALL** be addressed relative to DOE quality requirements cited in Sections 7 and 8 of this document, including DOE Order 414.1 and 10 CFR 830.120, Quality Assurance.

## 2.2 RECONNAISSANCE LEVEL CHARACTERIZATION (RLC)

RLC is project-specific and provides an overall assessment of the contamination, hazards, and other conditions associated with each building. The RLC is conducted to establish a preliminary estimate of the type and volume of contamination, to identify safety hazards present at the facility, and to "type" the facility. The RLC **SHALL** meet or exceed the requirements of RFCA, Attachment 9. The RLC **SHALL** obtain sufficient data to establish the basis for planning disposition. The RLC applies to Type 1, 2 and 3 facilities, and **SHALL** be conducted in accordance with the RFETS Reconnaissance Level Characterization Plan for D&D Facilities (refer to Appendix D).

This phase includes the review of project-specific information gathered during scoping characterization to identify data gaps and determine the need for additional sampling/surveys. If data gaps are identified during the RLC process, additional sampling/surveys **SHALL** be conducted by implementing the RLCP, which includes guidance on characterizing specific contaminants. Characterization instructions **SHALL** be documented in an RLC characterization package. Results **SHALL** be documented in the RLCR. If data gaps are not identified, additional sampling/surveys are not required, and the RLCR is prepared. This report identifies the proposed facility type to the Department of Energy (DOE) and is provided to the Lead Regulatory Authority for concurrence.

Because Type 1 Facilities should be free of contamination, RLC for Type 1 facilities **SHALL** be designed and conducted to meet the DQOs for the PDS. After a facility is determined to be a Type 1 facility (that is, following the LRA's concurrence on the RLCR), no further characterization will be required under RFCA.<sup>1</sup>

<sup>1</sup> This does not mean that no additional characterizations will be done for Type 1 facilities. In accordance with Section 2.2 of the *Decommissioning Program Plan*, the DOE may choose to remove materials containing polychlorinated biphenyls (PCBs) and asbestos pursuant to other laws which regulate DOE actions independently from RFCA. In the event the decision is made to remove these materials, DOE will conduct characterizations required under the relevant regulations.

RFETS approach to conducting RLC is presented in the Reconnaissance Level Characterization Plan for D&D Facilities (Appendix D). This Plan gives RLC implementation guidance, and details how to consistently conduct RLC in a compliant, technically defensible, and cost-effective manner.

### 2.3 IN-PROCESS CHARACTERIZATION (IPC)

IPC is performed during project strip-out and/or decontamination activities for Type 2 and 3 facilities. This phase of characterization is used to:

- Validate project plans and engineering alternatives presented in the decommissioning decision document;
- Develop IWCPs and related health and safety controls;
- Identify additional radiological, chemical and safety hazards that may be uncovered during facility strip-out and decontamination;
- Confirm the adequacy of decontamination ;
- Determine residual levels of contamination ;
- Guide pre-demolition survey planning; and
- Ensure that adequate data are obtained for waste management and transportation purposes.

Characterization instructions **SHALL** be summarized in an IPC characterization package. Refer to Appendix C for applicable DQOs identified for IPC. Results **SHALL** be summarized in the PDS Report (PDSR).

### 2.4 PRE-DEMOLITION SURVEY (PDS)

This characterization phase is used to verify that decommissioning objectives, including decontamination, have been met before building disposition. For example, the PDS is used to ensure that the building surfaces and/or structures meet applicable release criteria for radiological and non-radiological constituents, and to verify residual levels of radiological and non-radiological contamination. For Type 1 facilities, the PDS is conducted as part of the RLC per Section 2.2. All release criteria must be met. For Type 2 and 3 facilities, PDS is performed before building disposition. Decommissioning objectives are presented in the CERCLA facility-specific decommissioning decision document (refer to the DPP). PDS requirements are presented in the PDSP. Characterization instructions **SHALL** be documented in a PDS characterization package. Results, including demonstration that decision document objectives have been met, **SHALL** be documented in the PDSR for Type 2 and 3 facilities. For Type 1 facilities, the results of the PDS **SHALL** be included in the RLCR.

PDSs will focus primarily on radiological characterization. Characterization of non-radiological (chemical) hazards, such as beryllium, will be conducted during RLC and

IPC. Confirmation that related objectives have been met will be conducted during IPC and PDS, as necessary and will be documented in the PDS report.

Prior to PDSs, cross-contamination controls **SHALL** be established to ensure that areas do not become contaminated and that PDS data remain valid. If controls are not in place, areas could be contaminated prior to, during and after PDSs by adjacent activities and by traffic going through the areas. Such contamination or the potential for contamination would invalidate PDS data.

## **2.5 DATA ASSESSMENT**

Characterization data assessments **SHALL** be conducted to evaluate whether the data gathered during all characterization phases meet the objectives of this Protocol and to ensure that the data are sufficient to assure compliance. Assessments include verification and validation (V&V) and data quality assessment (DQA). V&V determines how well characterization packages were followed and if measurement systems performed in accordance with specified criteria. DQA determines if the data are of the right type, quality and quantity to support their intended use. These steps assure that requirements prescribed in the RLC and the PDS Plans were implemented correctly, and that the data gathered during characterization was performed within established quality control requirements. Section 8.0 describes the quality assurance data review process and defines the requirements associated with data V&V per this Protocol.

### **2.5.1 Independent Verification and Validation (IV&V)**

DOE may elect to have an "independent V&V" performed on data gathered during characterization. Such an assessment will involve verifying that work activities were performed in accordance with approved plans and procedures, including those governing field measurements, sample collection, laboratory analysis, and quality assurance. IV&V will also ensure that the PDS characterization package was based on the Site-Wide PDSP and its DQOs. IV&V results should be incorporated into the PDSR.

DOE's decision as to whether or not to perform IV&V and the extent of the IV&V will be based upon criteria such as experience with similar facilities including lessons learned, building-specific issues such as levels of contamination following decontamination, the potential environmental and liability concerns, and stakeholder/ regulator input to the RFCA decision document or RFCA decision. Decisions as to what facilities will undergo IV&V will be determined using the consultative process.

### 3.0 REPORTING REQUIREMENTS

The RLCR and PDSR **SHALL** provide an analysis of the characterization/survey results and summarize the hazards and risks associated with them. These reports, described below, document the process knowledge and history (HSA) and/or characterization survey results that will enable project personnel to develop and confirm disposition decisions (e.g., recycle, reuse or disposal of building components). Results will determine how the components (e.g., walls, floors, ceilings and fixed equipment) should be segregated and managed (e.g., pursuant to all applicable waste management regulations and requirements).

#### 3.1 RECONNAISSANCE LEVEL CHARACTERIZATION REPORT (RLCR)

The characterization results for Type 1, 2 and 3 facilities result in, a RLCR. The RLCR **SHALL** provide an analysis of the characterization results and summarizes the hazards and risks associated with the facility, including the nature and extent of radiological and chemical contamination, the presence of physical hazards, and an estimate of the types and volumes of wastes to be managed. Results of the scoping characterization **SHALL** also be incorporated into the RLCR. Based on an assessment of radiological and chemical contamination, the facility will be classified pursuant to the DPP. Compliance with data quality and review requirements **SHALL** also be documented, as described in Section 8. The report **SHALL** provide information in adequate detail to allow DOE and the LRA to determine if the facility is free of contamination or exhibits significant contamination or hazards, as required by Attachment 9 of the RFCA. An outline for the RLCR is presented in the RLCP.

#### 3.2 PRE-DEMOLITION SURVEY REPORT (PDSR)

The documentation of PDS results in a RFCA-mandated report for Type 2 and 3 facilities. The PDSR **SHALL** provide data on the nature and extent of radiological and chemical contamination after strip-out and decontamination. Results of IPC characterizations **SHALL** be documented in this report. Compliance with data quality and review requirements **SHALL** also be documented, as described in Section 8. The PDSR will demonstrate that cleanup and decontamination goals in the decision document have been met. It **SHALL** also document that building components may be free-released, or **SHALL** indicate if and where any residual contamination remains. An outline for the PDSR is presented in the PDSP.

## 4.0 KEY REGULATIONS, REQUIREMENTS AND GUIDANCE

This section provides an overview of the key, high-level regulations and requirements that drive decisions for both radioactive and non-radioactive contaminants. These regulations and requirements apply to all phases of the facility characterization program and are applicable to each and every facility at the RFETS. The regulations and requirements include applicable DOE orders, and State and Federal regulations, which are briefly discussed below and identified in Table 4.1. These requirements, however, are not all inclusive. Other requirements include DOT regulations and the waste acceptance criteria of individual waste disposal facilities. Requirements are incorporated into the DQOs, as inputs to the decisions and as specific decision rules (refer to Section 5.0 of this document and to DQOs presented in the RLCP, Appendix C of this document, and the PDSP).

### RADIOLOGICAL CONTAMINANTS

**DOE Order 5400.5, Radiation Protection of the Public and Environment**, provides the guidance and direction for release of material and personal property. Contamination thresholds are established for radiological survey measurements for transuranics, natural occurring thorium, natural occurring uranium, tritium, and other beta-gamma emitters. These thresholds are the same as those contained in NRC Regulatory Guide 1.86.

**DOE No-Radioactivity-Added (NRA) Waste Verification Program** (EG&G, 1993) provides the guidance and direction for the release of volume contaminated materials, i.e., concrete, cinder block, pavement, etc. Contamination thresholds are compared with limits in DOE Order 5400.5 (DOE, AME: TAD: PPP: 02637, April 23, 1998, Application of Surface Contamination Guidelines from DOE Order 5400.5).

**Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)** (DOD/DOE/NRC, 1997) provides the guidance and direction used at RFETS for conducting Pre-Demolition Surveys regarding free-release of structures. Sections of MARSSIM which apply to Site Closure are:

- **Section 3, Historical Site Assessment**, describes the historical review process;
- **Section 4, Preliminary Survey Considerations**, describes decommissioning criteria, background reference areas, survey units and quality control;
- **Section 5, Survey Planning & Design**, describes the design of the final status survey, how the results of the survey are evaluated, and how they are documented;
- **Section 6, Field Measurement Methods and Instrumentation**, describes Data Quality Objectives, measurement methods, detection instrumentation and data analysis;
- **Section 7, Sampling and Preparation for Laboratory Measurements**, describes Data Quality Objectives and sampling and analysis requirements for laboratory support.

- **Section 8, Interpretation of Survey Results**, describes the data quality assessment process and the statistical tests which apply; and
- **Section 9, Quality Assurance and Quality Control**, describes quality assurance planning, data verification and validation.

## **HAZARDOUS WASTE**

**6 CCR 1007-3, Parts 261 and 268**, provides the guidance and direction for evaluating waste streams as hazardous waste, i.e., contain listed or exhibit a characteristic of a hazardous waste, or mixed waste, i.e., hazardous waste with radiological contamination.

## **HAZARDOUS SUBSTANCES**

**40 CFR 302.4** lists hazardous substances and reportable quantities that must be considered during facility characterization and decontamination, and reported to the waste disposal facilities.

## **POLYCHLORINATED BIPHENYLS (PCBs)**

**40 CFR 761** provides direction for evaluating PCB contamination. **40 CFR 257.5 through 257.30** and **40 CFR 258** provide guidance for disposal of PCB Bulk Product Waste.

## **BERYLLIUM**

**10 CFR 850** provides direction for evaluating beryllium contamination. Letter dated January 4, 2001, Mr. Joe Legare, DOE, to Mr. Steve Gunderson, CDPHE, and Mr. Tim Rehder, EPA, provides further guidance on implementing 10 CFR 850.

## **ASBESTOS**

**40 CFR 763** and **5 CCR 1001-10** contain guidance and direction for evaluating waste. **29 CFR 1926.1101** contains guidance for the management of materials during decommissioning and demolition activities for worker protection.

Table 4.1 provides a summary of the key regulations and requirements and what phase in the characterization program they apply.

**TABLE 4.1 KEY REGULATIONS, REQUIREMENTS AND GUIDANCE**

Phase of Characterization	Radiological	Hazardous Waste	Hazardous Substances	PCBs	Beryllium	Asbestos
Scoping	MARSSIM Section 3.4	6 CCR 1007-3, Parts 261 and 268	40 CFR 302.4	40 CFR 257.5 through 257.30; 40 CFR 258; 40 CFR 761	6CCR 1007-3, Part 261, 10 CFR 850, and DOE letter	40 CFR 763 and 5 CCR 1001-10
Reconnaissance Level	DOE Order 5400.5	6 CCR 1007-3, Parts 261 and 268	40 CFR 302.4	40 CFR 257.5 through 257.30; 40 CFR 258; 40 CFR 761	6CCR 1007-3, Part 261, 10 CFR 850, and DOE letter	40 CFR 763 and 5 CCR 1001-10
	DOE No-Rad-Added Program					
In-Process	DOE Order 5400.5	6 CCR 1007-3, Parts 261 and 268	40 CFR 302.4	40 CFR 257.5 through 257.30; 40 CFR 258; 40 CFR 761	6CCR 1007-3, Part 261, 10 CFR 850, and DOE letter	40 CFR 763 and 5 CCR 1001-10
	DOE No-Rad-Added Program					
Pre-Demolition Survey	DOE Order 5400.5	6 CCR 1007-3, Parts 261 and 268	40 CFR 302.4	40 CFR 257.5 through 257.30; 40 CFR 258; 40 CFR 761	6CCR 1007-3, Part 261, 10 CFR 850, and DOE letter	40 CFR 763 and 5 CCR 1001-10
	DOE No-Rad-Added Program					
	MARSSIM Sections 4.0 - 9.0					

## 5.0 OVERVIEW OF THE DATA QUALITY OBJECTIVE (DQO) PROCESS

Establishing characterization requirements **SHALL** identify the data required to support disposition decisions. This section describes the EPA DQO process, which **SHALL** be applied to facility characterization at RFETS. Implementing this process helps determine the data needs of each D&D project, evaluate whether existing data are useful, and optimize the number and types of additional measurements taken and analyses completed.

A means to ensure adequate data quality is adherence to this characterization protocol, as well as the RLCP and the PDSP, throughout the facility disposition process. Characterization results will be used to support various decommissioning decisions, such as technology selection, alternative development, material release, and waste management. Results will also be used by other organizations in making decisions associated with occupational safety, industrial hygiene, environmental protection, regulatory compliance, etc. Therefore, decommissioning project personnel **SHALL** provide characterization results to all appropriate Kaiser-Hill (K-H) Team organizations.

### 5.1 DQO PROCESS

The DQO process is a systematic approach to ensure that data are acquired and evaluated according to their intended use. Coupled with verification and validation (V&V), DQOs establish a framework providing for technically sound decisions. The DQO process involves the following seven steps:

1. State the Problem;
2. Identify the Decision;
3. Identify the Inputs to the Decision;
4. Define the Boundaries of the Decision;
5. Develop the Decision Rule;
6. Specify Tolerable Limits on Decision Errors; and
7. Optimize the Design for Obtaining Data.

The following sections apply the DQO process to the RFETS Characterization Program associated with D&D activities.

#### The Problem

The initial problem is that "definitive" quantities and "types" of contaminated media, materials, equipment, and structures are not known and must be determined before an approach for facility disposition and the management of waste streams can be determined. Surveys/samples must be taken prior to demolition to properly characterize materials to determine appropriate management of materials and/or equipment resulting from the decommissioning process.

## **The Decision**

Because decommissioning decisions determine data needs, the decisions must be clear and well defined. Key examples of critical technical decisions include:

- Determining whether materials, media, or fixed equipment within the facility are contaminated or not contaminated.
- Determining the wastestream categories that will result from disposition and associated quantities. The categories may include radioactive (low-level and transuranic) waste, hazardous waste, PCB and asbestos waste, mixed waste, and sanitary waste.

## **Inputs to the Decision**

Inputs to the decisions include both qualitative and quantitative data. Qualitative information typically consists of historical data, process knowledge derived from operating records and interviews, and data derived from visual observation of a building's equipment and materials. Quantitative data may be produced from analytical data, field surveys, and/or analysis of samples. Other inputs to the quantitative decision may include the following:

- Method-specific sensitivities (e.g., detection limits or minimum detectable activities);
- Error tolerances associated with the measurements (e.g., accuracy and precision); and
- Action levels (e.g., regulatory thresholds from RFETS free-release criteria or RFCA).

The WAC and associated implementing procedures are typically the drivers for decision inputs where data will be used to characterize waste streams destined for a particular TSDF (e.g., Waste Isolation Pilot Plant, Nevada Test Site, Envirocare or USA Waste). Data for use in setting DQOs will be radionuclide- and chemical-specific.

## **Decision Boundaries**

Decision boundaries include the geographic area(s), volume(s), and temporal boundaries of the characterization activity. Temporal boundaries generally refer to frequency of data collection, the period of time a standard/regulation cannot be exceeded, and the period of time over which data should be averaged. Other boundaries include the sample population of interest and any constraints on the data collection.

## Decision Rules

Decision rules are a series of "if-then" statements developed to establish the basis on which decisions are made. Decision rules must be based on objective, reproducible, and measurable criteria, and must be consistent with information developed during the first four steps of the DQO process. All decision rules should be considered prior to finalizing the characterization plan.

## Tolerable Limits on Decision Errors

The level of acceptable uncertainty associated with characterization results must be established prior to characterization. Acceptable false positive and negative errors generally range from 1% to 10%, and **SHALL** be stated in the characterization packages.

This level of uncertainty is used to determine the number of samples to be taken. The less error that is acceptable, the more samples will be collected. The number of required samples can be calculated based on guidance in the following documents: Data Quality Objectives (EPA QA/G-4, 1994), MARSSIM (Section 5.5.2.3, "Contaminant Not Present - Determining Number of Data Points for Statistical Tests") and/or Cost Benefit Enhancements (DOE/EM-0316, 1996).

## Optimization of Sampling Design

The DQOs may be modified to reflect visual observations, data gaps, and professional judgment. If data gaps are identified as the project progresses or new information becomes available, additional sampling may be necessary. The sampling design is modified and optimized until the required, minimum confidence level is achieved for the project. The design may go through several iterations of optimization, depending on the sample data available and the inferences made from each unique sample set.

## 5.2 APPLICATION OF DQOs TO THE D&D CLOSURE PROGRAM

DQOs **SHALL** be selected, refined as necessary, and incorporated into characterization packages based on the type of facility being decommissioned and the phase of decommissioning. Type 1 facilities **SHALL** be subjected to a RLC which meets the requirements of a PDS before being dispositioned. Type 2 and 3 facilities **SHALL** be subjected to RLC, IPC, and PDS, with each phase of characterization using a different set of DQOs. Refer to the DQOs in the RLCP (Section 2.0), PDSP (Section 2.0), and Appendix C of this Protocol.

Data sets from previous characterizations serve as a key input to each characterization phase and its related set of DQOs. Such data can significantly assist in focusing the next characterization phase, thereby resulting in time and cost savings. The usability of

previous data will depend on their quality. If the data were not collected under a quality program and/or cannot be validated as accurate, they **"cannot and will not"** be used.

## 6.0 SAMPLING AND ANALYSIS

The DQO process will identify sampling and analysis needs. If existing data or process knowledge are not available to support a D&D decision, sampling and analysis are required. This section provides an overview of the sampling requirements for the non-radioactive contaminants, and the methods required to determine the chemistry of the samples. These methods **SHALL** be implemented following determination of the project-specific DQOs. For radiological field measurement methods and instrumentation, radiological sampling, and the preparation of radiological samples for laboratory measurements refer to Appendix C of this Protocol, and the RLCP and PDSP for further guidance.

### 6.1 ASBESTOS

Materials potentially containing asbestos **SHALL** be categorized and sampled per 40 CFR 763.86 and 5 CCR 1001-10, by a CDPHE-Certified Asbestos Inspector. The presence of asbestos (i.e., > 1% by volume) **SHALL** be determined at a laboratory with asbestos accreditation (NIST and NVLAP). The acceptable asbestos characterization method is EPA 600/R-93/116.

### 6.2 POLYCHLORINATED BIPHENYLS (PCBs)

Materials and media potentially contaminated with PCBs **SHALL** be categorized per 40 CFR 761. If material meets the definition of PCB Bulk Product Waste, it may be disposed of at a facility that is permitted, licensed, or registered by a State to manage municipal solid waste subject to 40 CFR 258, or non-municipal, non-hazardous waste subject to 40 CFR 257.5 through 257.30. For most bulk product wastes, implementing this strategy precludes the need for PCB characterization prior to or during facility disposition, as long as restrictions outline in 40 CFR 761.62 regarding their disposal are met. However, notification to the disposal facility is required at least 15 days in advance of shipping wastes to the facility if that disposal facility does not possess a commercial PCB storage or disposal approval. If some construction debris (e.g., concrete) is to be recycled on-site, the paint on the material **SHALL** be sampled and analyzed, as appropriate, to determine if the material is subject to regulations governing PCB bulk product waste.

Management strategy for PCB remediation waste will be determined on a case-by-case basis. If PCB contamination is suspected, or if a PCB spill is discovered that has not been cleaned up, the area will be treated as directed by the most recent versions of 40 CFR 761 through 766. For each planned cleanup, PCB regulations under TSCA will be evaluated as potentially applicable or relevant and appropriate requirements (ARARs), including the disposal options for PCB remediation waste listed under 40 CFR 761.61.

The analytical method **SHALL** have a practical quantitation limit (PQL) of less than 50% of the regulatory threshold that applies to the particular type of waste. SW-846

Methods 4020 and 8082 satisfy this criterion.

### 6.3 HAZARDOUS WASTE AND SUBSTANCES

Materials and media potentially contaminated with hazardous waste and substances **SHALL** be characterized using process knowledge and/or analyzed for compounds and elements in accordance with 6 CCR 1007-3, Parts 261 and 268 (for hazardous waste), and 40 CFR 302.4 (for hazardous substances). Analytical methods **SHALL** have PQLs at levels better than 50% of the regulatory thresholds. The SW-846 methods or equivalent industry-proven methods **SHALL** be used for analyses as specified in the receiving site's WAC and waste analysis plan.

### 6.4 BERYLLIUM

Media potentially contaminated with beryllium **SHALL** be characterized using process knowledge and/or chemical analysis of smear samples. Samples **SHALL** be analyzed by EPA SW-846 methods (6010B, with total digestion by 3052, 3050B, or 3051 depending upon the matrix) or equivalent, such as OSHA Method ID-125G for flame atomic absorption spectroscopy, or OSHA Method 125-G for inductively coupled plasma spectroscopy. The PQL will be less than or equal to one half the beryllium investigation level of  $0.1 \mu\text{g}/100 \text{ cm}^2$ , i.e., less than  $0.05 \mu\text{g}/100 \text{ cm}^2$ .

## 7.0 QUALITY ASSURANCE AND QUALITY CONTROL

This section defines the requirements and controls that are employed and implemented by K-H to conduct facility characterization with adequate technical defensibility, and provides a roadmap of the applicable documents, procedures, and standards. Quality assurance/quality control (QA/QC) criteria listed in this section supplement the K-H *Quality Assurance Program* (QAP) by emphasizing requirements applicable to planning and implementation of facility characterization. The application and implementation of these criteria **SHALL** be consistent with the graded approach. In practical terms, the graded approach requires selective application of QA/QC requirements commensurate with their importance to safety and project objectives.

### 7.1 PERSONNEL TRAINING & QUALIFICATION

All personnel conducting surveys or performing activities described in this document **SHALL** receive training and qualify in the procedures performed. The extent of training and qualification should be proportional to the education, experience, and proficiency of the individual, and the scope, complexity, and nature of the activity. Training should be designed to achieve initial proficiency and to maintain that proficiency over the course of the survey process or other activity. Records of training, including testing to demonstrate qualification, must be documented.

Training requirements are presented in 1-10000-TUM, Training User's Manual, Site *Radiological Control Manual* (RCM; Chapter 6, Parts 2, 3, and 4). Relevant training material is presented in specific characterization procedures referenced in this Protocol, the RLCP, and the PDSP.

### 7.2 QUALITY IMPROVEMENT

Quality improvement **SHALL** be realized through use of a systematic means of identifying, tracking, and correcting issues (deficiencies, nonconformances, issues, etc.). The extent of causal analysis and corrective action **SHALL** be commensurate with the significance of the failure or problem. Lessons learned **SHALL** be communicated to staff from management where appropriate. Documents referenced to support the implementation of quality improvement requirements are identified below:

Site Corrective Action Requirements Manual (1-MAN-012-SCARM)  
Site Integrated Oversight Manual (1-MAN-013-SIOM)  
Site Lessons Learned/Generic Implications Requirements Manual ,  
1-S27-ADM-16.18)  
Radiological Improvement Reports (1-H02-HSP-3.02)  
Stop Work Action (1-V10-ADM-15.02)  
Occurrence Reporting Process (1-D97-ADM-16.01)  
Performance Indication and Trend Analysis (1-E93-ADM-16.18)

Control of Non-conforming Items (1-A65-ADM-15.01)  
Control of Waste Nonconformances (2-U76-WC-4030)  
RFETS Radiological Control Manual (Site RCM)

### 7.3 DOCUMENT CONTROL, RECORDS & DATA MANAGEMENT

The document control process is described in procedure MAN-063-dc, *Document Control Program Manual*. Essential policies, plans, procedures, decisions, data, and transactions of the project **SHALL** be documented to an appropriate level of detail. Records **SHALL** be maintained in accordance with 1-V41-RM-001, *Records Management Guidance for Records Sources*. Documents and records that must be placed in the CERCLA administrative record **SHALL** be dispositioned in accordance with 1-F78-ER-ARP, *CERCLA Administrative Program*.

### 7.4 WORK PROCESS

All characterization activities **SHALL** be executed using the RFETS *Integrated Work Control Program* (IWCP). The IWCP requires the preparation of work packages that provide work control and incorporate the *Integrated Safety Management* (ISM) principles. The ISM principles ensure workers are involved in the planning, hazard identification, and implementation of the demolition activities. The IWCP review process evaluates the activity, hazard identification, mitigation measures and compliance with the authorization basis documents.

#### 7.4.1 Survey/Sample Handling and Custody Requirements

Samples **SHALL** be managed to ensure there is an accurate record of sample collection, transport, analysis, and disposal to ensure that samples are neither lost nor tampered with and that the sample analyzed is traceable to a specific location in the field. A chain-of-custody form **SHALL** be completed for all samples and included as part of the characterization documentation as required by RSP-16.03, CAS-SOP-003 and laboratory analysis procedures. Survey packages and associated data **SHALL** be protected as specified in Site RCM Article 775 when not in use. If a survey was not completed, for example, by the end of the surveyor's shift, the surveyor's records **SHALL** be completed to the extent the survey was performed, and the subsequent surveyor **SHALL** start new records to complete the balance of the survey.

#### 7.4.2 Analytical Methods Quality Control Requirements

Sample analysis **SHALL** be performed as specified in the Statement of Work for Analytical Measurements modules. Laboratory sample QC checks will include, as appropriate, interlaboratory comparison studies (single- or double-blind standards), performance evaluation standards, laboratory control samples, laboratory duplicates, preparation blanks, trip blanks, field blanks, and duplicate samples.

### 7.4.3 Field Survey/Sampling Quality Control Requirements

The number of QC measurements is determined by the degree to which assurance is needed for adequate control of the measurement process. The process is simplified when the scope of the survey is narrowed to a single method, crew, or laboratory. Similarly, the number of required QC measurements increases proportionately with the number of samples or surveys and as action levels approach a given instrument's detection limit. To establish the overall precision, or reproducibility of scans and surveys, replicate, or duplicate, measurements **SHALL** be acquired at a minimum percentage of the non-QC scans/surveys. The minimum number of required QC surveys **SHALL** be determined as specified in the RLCP and PDSP.

Replicate surveys **SHALL** be performed with a different instrument and by a different surveyor than the one who performed the initial survey. This method provides an estimate of instrument and surveyor precision. The replicate survey results should be clearly marked to show that they are QC surveys and should reference the initial survey for comparison.

### 7.4.4 Transuranic Waste Management QA/QC Requirements

The applicability of facility characterization data for waste characterization **SHALL** be assessed and included in the project-specific waste management plan. For example, Transuranic (TRU) waste will need to be characterized in accordance with the *USDOE Carlsbad Area Office Quality Assurance Program Document*, CAO-94-1012. The data collected during facility characterization may be used as characterization data for the TRU waste, but the verification and validation of that data **SHALL** meet the requirements established by the *TRU Waste Management Manual*, 1-MAN-008-WM-001 and the *WIPP Isolation Pilot Project Transuranic Waste Characterization Program Quality Assurance Project Program Plan*, 95-QAPjP-0050.

## 7.5 DATA COLLECTION DESIGN

The requirements and rationale of the design for the collection of characterization data **SHALL** be derived from the quantitative outputs of the DQO Process. The PDS data are considered critical because they are required to achieve project objectives or limits on decision errors. Therefore, the level of QA/QC is more stringent for a PDS than that of RLC or In-Process surveys. The design assumptions are specified in the RLCP and PDSP.

### 7.5.1 Computerized Systems (Software/Hardware)

Design-control of computerized systems **SHALL** be commensurate with the hazards associated with the process for which the computer system controls. Software used in

characterization activities should be designed and validated in accordance with ASME-NQA-1-1994, Part II. Systems controlling critical health and safety processes **SHALL** be verified and validated as prescribed in either the Health and Safety Plan (HASP) or the RSPs and **SHALL** simulate working conditions prior to usage in real settings. Such systems **SHALL** also be tested periodically to ensure functionality as defined in the Site RCM or HSP. Computerized systems used for measurements **SHALL** be calibrated via system calibrations, i.e., while integrated with the relevant transducers. Computerized systems used for data reduction and analysis **SHALL** be controlled to ensure traceability of changes made to original data and allow independent peer reviewers to relate inputs to outputs

## 7.6 PROCUREMENT

Quality requirements **SHALL** be delineated in procurement and subcontract documents. All Statement of Work (SOW) distributed by companies at RFETS **SHALL** be reviewed by quality assurance representatives to ensure that adequate quality controls/ requirements are imposed on the subcontractor. Ongoing oversight of the subcontractor **SHALL** be performed to ensure that these controls are implemented. Procurement requirements are implemented through the following documents:

- Procurement System Manual
- Acquisition Procedure for Requisitioning Commodities and Services (IW36-APR-111).

## 7.7 INSPECTION & ACCEPTANCE TESTING

All characterization measurement results **SHALL**, at a minimum, be identified by actual result (not <MDC – minimum detectable concentration), date, instrument, location, type of measurement, and surveyor. Characterization data **SHALL** be reported with gross measurement results, reduced measurement results, and all associated parameters and calculations (e.g., model identification and parameter inputs and outputs) required to verify the reduced result. For final reporting purposes, survey and sample results **SHALL** be rounded and reported to significant figures that are consistent with the accuracy and precision associated with the specific measurements or calculations.

Calibration and maintenance of instrumentation **SHALL** be consistent with MARSSIM guidance; Any deviations from MARSSIM **SHALL** be documented and technically justified in the characterization survey reports.

### 7.7.1 Inspection/Maintenance/Testing of Instrumentation

Inspection, maintenance, and calibration of radiation instrumentation **SHALL** be performed as specified in the Site RCM Chapter 5 Part 6. Applicable calibration procedures identified include:

- 4-PRO-S86-ALPHA-HPI-3420, Calibration of the Electra with the Dual Scintillation Probe
- 4-177-HPI-2000, Calibration of the Ludlum Model 12-1A Count Rate Meter with Air Proportional Probe
- 4-C66-HPI-3410, Calibration of the Bicorn Frisk Tech with a B-50 Beta Probe; and
- 4-C67-HPI-3411, Calibration of the Bicorn Frisk Tech with a A-100 Alpha Probe.

All calibrations **SHALL** comply with the requirements of ANSI-N323, American National Standard Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments, as required by the Site RCM. Instrumentation not addressed in the referenced procedures **SHALL** be maintained in accordance with MAN-092-M&TE, Measuring and Test Equipment Management Manual.

If actual field conditions during characterization differ significantly from calibration conditions or assumptions, an additional calibration or performance check for the instrument(s) in the anomalous field condition(s) is required. The resulting accuracy and precision of the instrument **SHALL** be proven to be within "industry-accepted" tolerances, or within acceptable total uncertainties relative to the survey unit's derived concentration guideline level (DCGL) and final survey unit decisions. Correction factors, with acceptable technical basis may be used for measurement conversions. Recalibration is required if an instrument fails a performance check or if it has undergone repair or modification that could affect its response.

For portable instrumentation, calibrations should account for the substrate of concern (e.g., concrete, steel, roofing) or appropriate correction factors developed for the substrates relative to the actual calibration standard substrate. This is necessary because of significant adsorption and backscatter of alpha and beta emitters. Conversion factors developed during the calibration process should be for the same counting geometry as during the actual use of the detector.

Calibrations normally challenge the instruments at a number of different levels over the operating range. Since the range for the PDS will be much narrower, the calibration ranges may be reduced accordingly to improve accuracy. However, multipoint calibrations (three or more points per instrument range) are still required.

Calibration sources **SHALL** be traceable to the National Institute of Standards and Technology (NIST). Where NIST-traceable standards are not available, standards obtained from an industry recognized organization (e.g., the New Brunswick Laboratory for various uranium standards) **SHALL** be used.

## 7.8 MANAGEMENT AND INDEPENDENT ASSESSMENTS

Management assessments **SHALL** be planned, scheduled and performed by project management to assess an organization performing work to determine if the objectives,

goals and processes are adequate. Management assessment **SHALL** be documented through reports, internal memoranda, or other suitable reporting means.

Independent assessments **SHALL** be performed by personnel who are not directly responsible for the work to establish whether the prevailing management structure, policies, practices, procedures and data are adequate for ensuring that the quality of the results based on the risk and performance indicators needed are obtained. Deficiencies **SHALL** be identified, tracked and closed in accordance with the *Site Corrective Action Requirements Manual*. Assessment requirements are implemented through the documents identified below:

- Kaiser-Hill Management Assessment Program (3-W24-MA-002)
- Site Integrated Oversight Manual (1-MAN-013-SIOM)
- RFETS Radiological Control Manual (Site RCM)
- Radiological Assessments (RMRS/OPS-PRO.150)

## 8.0 DATA REVIEWS

Data collected during characterization **SHALL** be reviewed prior to incorporation into final reports to determine usability and compliance with RFCA and minimum quality requirements. Collectively, data review includes verification, validation (V&V, respectively), and quality assessment of the data. Precision, accuracy, representativeness, completeness, comparability and sensitivity (PARCCS) are specific aspects of the data review that are summarily covered by the data review process. Radiological data collected during the reconnaissance level and the in-process characterization **SHALL** also be reviewed according to the Radiological Control Manual and Radiological Safety Practices Procedures as applicable. Radiological data gathered during pre-demolition surveys **SHALL** be reviewed according to MARSSIM. Further detail is provided in the RLCP and PDSP.

### 8.1 DATA VERIFICATION AND VALIDATION (V&V)

Verification **SHALL** be performed on sets of data produced by the project on which decisions are based. Validation **SHALL** be performed on minimum percentages of data/data packages as stipulated in project-specific sampling and analysis plans. Analytical data **SHALL** be verified and validated according to RFETS Analytical Services Division guidelines (General Guidelines for Data Verification and Validation, DA-GR01-V1).

#### 8.1.1 Data Verification

Verification ensures that data produced and used by the project are *documented and traceable* per applicable quality requirements. For example, verification ensures that requirements relative to the data produced by the project are satisfactory with respect to quantity, types, and format of data specified in the applicable planning documents and data packages.

Every RLC and PDS report **SHALL** document assessment of the entire data set used for decisions as defined in the DQO section. A section of the report **SHALL** explain the steps and criteria used for data verification and validation, including qualified and rejected data, and a summary table of all methods used, real samples, and QC samples. All data should be verified.

#### 8.1.2 Data Validation

In contrast to data verification, data validation is an in-depth technical review of the data that determines whether characterization was performed within quality control requirements and tolerances. Depending on the project and the critical nature of samples, a percentage of the entire data may be validated, so long as the percentage is representative. For example, validation percentages should include the following:

- Results from all laboratories used during the project;
- Results from samples collected by each subcontractor and/or representative of each of the project subcontractor's work;
- Results from each medium sampled; and
- Results from each analytical method used.

A validation rate of greater than or equal to 25% is currently used at the RFETS, based on acceptance of previous work plans by EPA Region VIII and CDPHE. A lower validation rate may become acceptable to the agencies; however, depending on the number of critical samples or surveys for a given project, higher frequencies of validation may be desired for higher confidence. MARSSIM Appendix N also provides guidance for data validation.

#### 8.1.2.1 Precision

Precision measures the reproducibility of measurements. It is defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. Analytical precision is the measurement of the variability associated with duplicate (two) or replicate (more than two) analyses. The laboratory control sample duplicates (LCSD) **SHALL** be used to determine the precision of the analytical method.

Overall project precision is the measurement of the variability associated with the entire sampling and analysis process within the project. It is determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations. Field duplicate samples and matrix duplicate spiked samples **SHALL** be analyzed to assess overall project and laboratory precision, respectively.

The precision measurements **SHALL** be determined using the relative percent difference (RPD) between the sample results and the duplicate error ratio (DER). RPD values are determined for non-radiological measurements, and DER values are used for radiochemistry measurements.

DER values, in contrast to strictly deterministic relative percent differences in measurements, consider uncertainty associated with both measurements, as well as the single reported values. Such a comparison is statistical in nature, and has associated statistical confidence built into the comparison that is chosen by the decision-maker (e.g., comparison with a selected z-score that corresponds to a 95% confidence). Other controls that define the precision include control or tolerance charting (daily minimum) at a plus or minus threshold for radiological surveys.

#### 8.1.2.2 Accuracy

Accuracy is a measurement of how closely the measured value corresponds to the true value, and includes components of random uncertainty and systemic error. Therefore, accuracy reflects the total uncertainty associated with a measurement.

Analytical accuracy **SHALL** be measured by comparing the percent recovery of analytes (spiked into a laboratory control sample duplicate) to a control limit. For volatile and semivolatile organic compounds, surrogate compound recoveries **SHALL** also be used to assess accuracy and method performance for each sample analyzed. Analysis of performance evaluation (PE) samples **SHALL** also be used to ensure quality control for atypical contaminants or radionuclides of concern, or when interference is an issue. Accuracy **SHALL** be calculated and qualified for each D&D QA sample batch, and the associated sample results **SHALL** be interpreted by considering these specific measurements and other qualitative considerations. Measurement uncertainties, both quantitative and qualitative, **SHALL** be reported for all data sets used in decision-making (see MARSSIM, Section 6.8).

#### 8.1.2.3 Representativeness

Representativeness means the degree to which the data accurately and precisely represent a characteristic of a population parameter, variation of a property, a process characteristic or an operational condition. Representativeness is a qualitative parameter focused on the proper design of the sampling program.

Objectives for representativeness are defined for each sampling and analysis task and are a function of the investigative objectives. Representativeness **SHALL** be achieved through use of the standard field, sampling, and analytical procedures. Representativeness **SHALL** also be determined by appropriate program design, with consideration of elements such as sample locations, matrix and sample type, and number of samples.

#### 8.1.2.4 Completeness

To produce credible and defensible data sets for decision-making, the data must be complete relative to the original sample plan(s). Therefore, completeness **SHALL** be calculated and reported for each method, matrix and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, will determine the completeness of the data set. For completeness requirements, valid results **SHALL** be all results not rejected due to inadequate quality control. The percentage requirements for completeness **SHALL** be 100% for critical samples and 90% for the project as a whole. For any instances of samples that could not be analyzed for any reason (e.g., holding time violations in which re-sampling and analysis were not possible, samples spilled or broken, etc.), the numerator of the

calculation **SHALL** become the number of valid results minus the number of possible results not reported. The formula for calculation of completeness is presented below.

$$\% \text{ completeness} = \frac{\text{Number of valid results}}{\text{Number of planned results}} \times 100$$

Where absolute regulatory requirements for sample set completeness are undefined, statistical methods for evaluating completeness of data sets **SHALL** be applied, such as those methods described in MARSSIM (Section 9) (DOE/DOD/NRC, 1997), EPA G-4 (EPA, 1994) and G-9 (EPA, 1996). These methods include use of:

- Power curves relative to hypothesis testing;
- Analysis of means and variabilities relative to regulatory action levels;
- Evaluation of outliers and dispersion;
- Transformations; and
- Tests on distributional assumptions.

If other scientifically recognized methods for evaluating sample sets are implemented, the methods and results **SHALL** be included in the corresponding final report.

#### 8.1.2.5 Comparability

Comparability is the confidence with which one data set can be compared to another data set. One of the objectives of characterization is to produce comparable data. The number of matrices that are sampled and the range of field conditions encountered are considered in determining comparability. Comparability **SHALL** be achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions, and using standard and comprehensive reporting formats. Complete field documentation using standardized data collection forms **SHALL** support the assessment of comparability. Analysis of PE samples and reports from audits **SHALL** also be used to provide additional information for assessing the comparability of analytical data produced among subcontracting laboratories. Historical comparability **SHALL** be achieved through consistent use of methods and documentation procedures throughout the project.

## 8.2 DATA QUALITY ASSESSMENT (DQA)

DQA is a scientific and statistical evaluation that determines if the data are of the right type, quality, and quantity to support their intended use, which in this case, is to make decisions regarding D&D. More specifically, the DQA is an evaluation of the data specifically with respect to the project's DQOs and action levels, and could, as

applicable, encompass statistical methods as described in EPA QA/G-9. Although some data assessment will be performed before or in parallel with data V&V (i.e., confirmation), the DQA **SHALL** not be final until V&V are complete. This restriction is necessary since the data assessment assumes that the individual data constituting statistics and parameters are satisfactory for their intended purpose and based on quality requirements.

The DQA process, as defined by EPA QA/G-9 (EPA, 1996) and MARSSIM (NUREG-1575) constitutes the guidance for assessing the quality of data. MARSSIM addresses DQA in Section 8.0 and more specifically in Table 2.3 and Appendices E and I. The assessment **SHALL** include evaluating sample quantities, and sources and magnitudes of uncertainty relative to tolerances allowed in the DQO process, as guided by the RLCP and the PDSP, including both systematic and random sources of error. The G-9 process consists of the following five steps:

1. Review DQOs;
2. Conduct preliminary data review;
3. Select statistical test;
4. Verify assumptions of the statistical test; and
5. Draw conclusions from the data.

## 9.0 REFERENCES

EPA, 1986. U.S. Environmental Protection Agency. Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup, (EPA-560/5-86-017).

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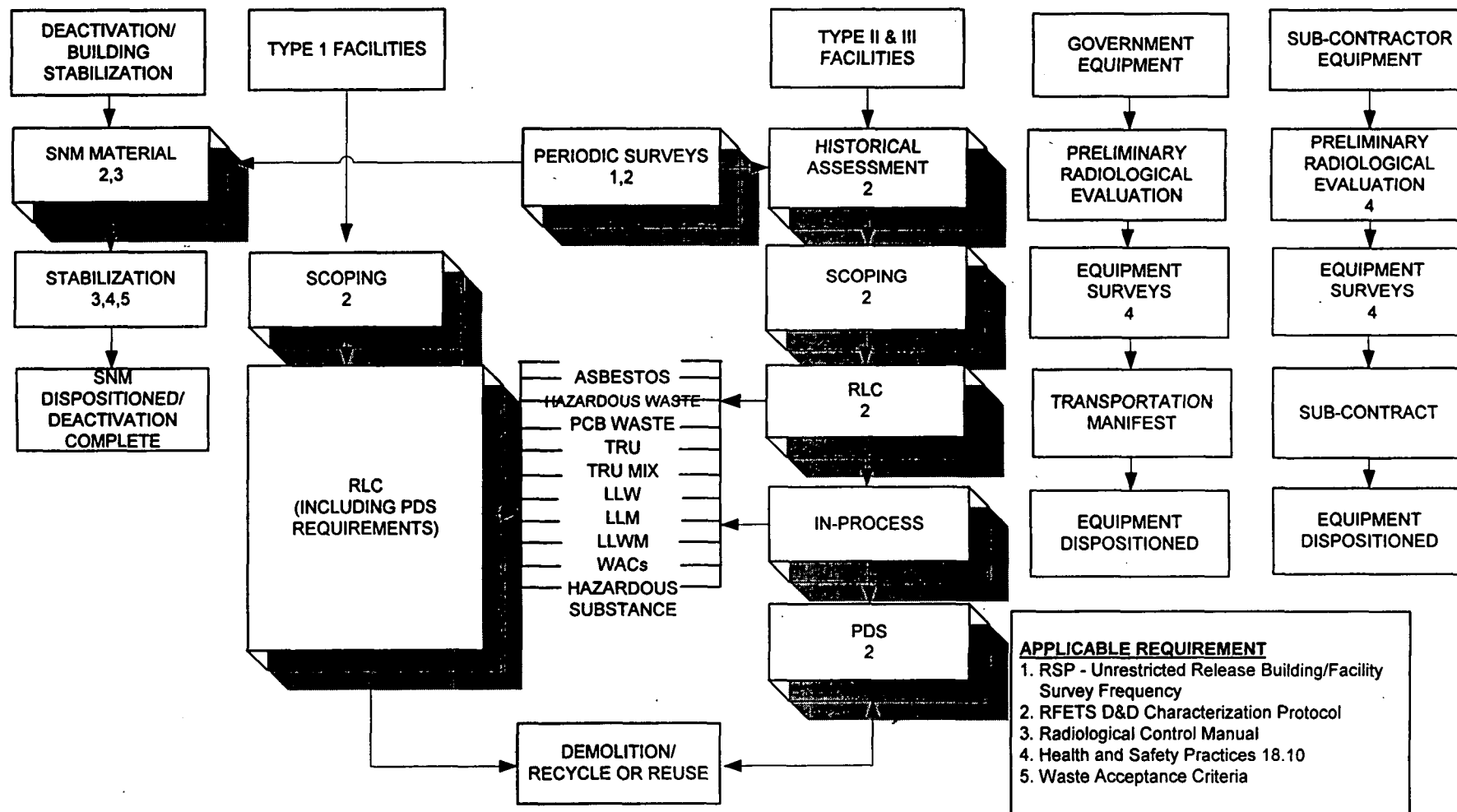
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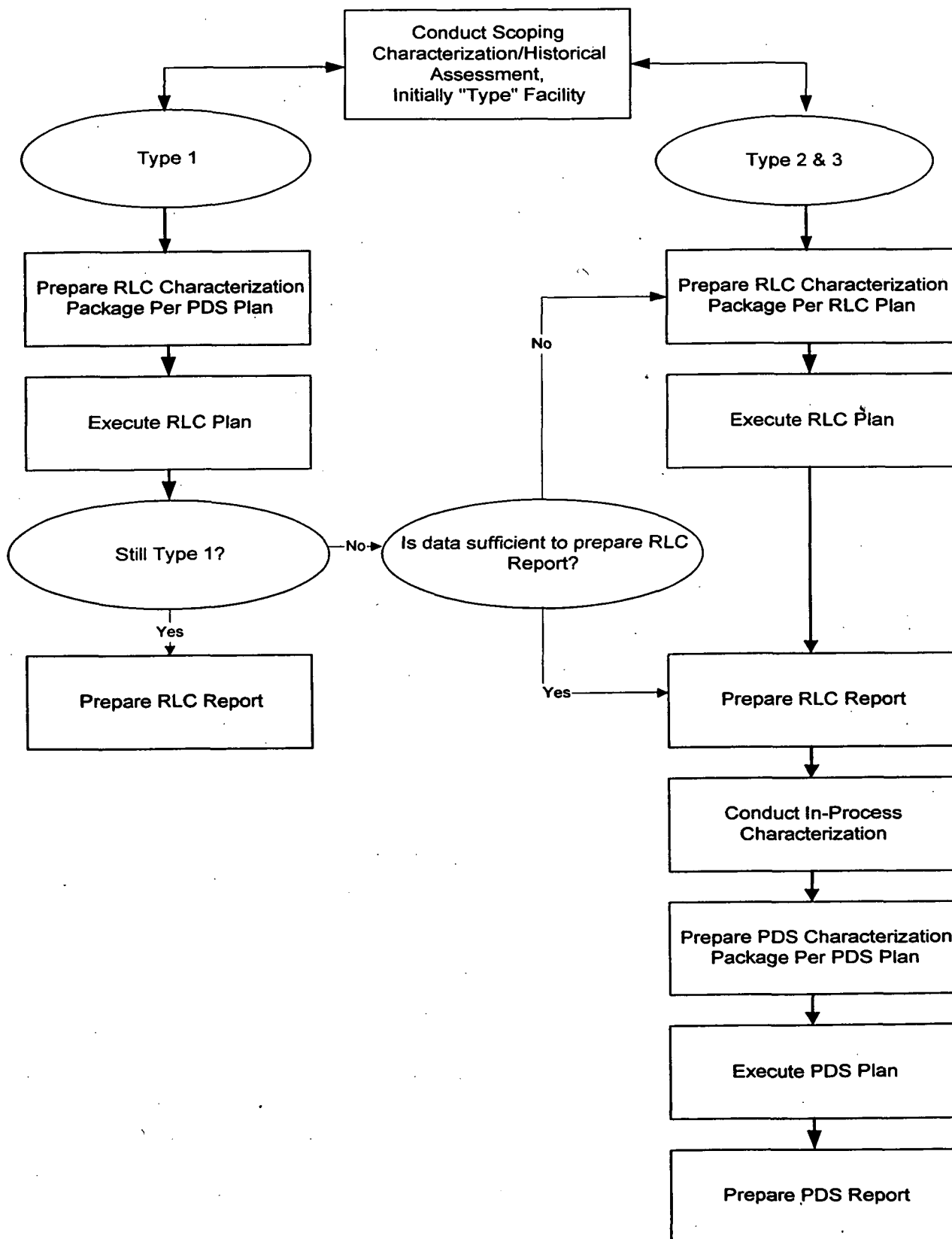
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## Appendix A The RFETS Characterization Process



## Appendix B The D&D Characterization Process Logic Diagram



## **APPENDIX C**

### **DQOs FOR IN-PROCESS CHARACTERIZATION**

The following sections outline the DQO process for performing In-process Characterization.

#### **The Problem**

The problem involves characterizing the nature and extent of radiological and hazardous substance contamination in order to 1) evaluate required extent/methods of disposition; 2) estimate approximate volumes of sanitary, low-level (LLW), low-level mixed, transuranic (TRU), transuranic-mixed, other hazardous waste, hazardous substance and PCB, beryllium, and asbestos waste generated during the D&D process; 3) evaluate on-going decommissioning activities; 4) identify additional radiological, chemical and safety hazards that may be uncovered during facility strip-out and decontamination; 5) confirm the adequacy of decontamination; 6) determine residual levels of contamination; and 7) provide input to the pre-demolition (final) survey design.

#### **The Decision**

The critical decision is determining what health and safety controls need to be established and what regulatory category (RCRA, etc.) should be assigned to the various waste streams (refer to section 5.1) generated during decommissioning. Characterization data evaluation will involve assessing if enough validated data exists to adequately describe the nature and extent of contamination.

#### **Inputs to the Decision**

The inputs to the decision include the RLC and IPC data and information generated from previous activities (e.g. scoping characterization, etc.), as well as the decision document action levels, unrestricted release criteria, transportation requirements, waste management regulations, pollution prevention/waste minimization criteria, ALARA, and WAC.

#### **Decision Boundaries**

The decision boundaries are the spatial confines of the selected survey area(s).

#### **Decision Rules**

This section develops the rules from which decisions are made concerning characterization data. There are some very specific rules related to individual

contaminants of interest. The following are general guidelines for decision rule development:

- If there is an inventory/estimate of remaining materials, media, equipment, floors, walls and ceilings within the facility, no inventory/estimates are necessary; otherwise, inventory/estimates are necessary.
- If materials are found to be non-radioactive, non-hazardous, non-beryllium contaminated, non-TSCA and non-ACM, then material can be free-released, and reused, recycled or disposed of as sanitary waste.

### **Radionuclides**

- If all radiological survey and scan measurements are below the surface contamination guidelines provided in DOE Order 5400.5 (Radiation Protection of the Public and Environment; see Table 7-1), and if all radiological sample measurements are below the volume contamination thresholds provided in the No-Rad-Added Verification (NRA) Program (refer to Kaiser-Hill letter to DOE, RFFO, Application of Surface Contamination Guidelines from Department of Energy Order 5400.5 - WAH-064-98, March 10, 1998), the related volume of material is considered not radiologically contaminated.
- If any radiological survey and scan measurement exceeds the surface contamination thresholds provided in DOE Order 5400.5, the associated surface area is considered radiologically contaminated.
- If any radiological sample measurement exceeds the volume contamination threshold provided in the NRA Program (refer to Kaiser-Hill letter to DOE, RFFO, Application of Surface Contamination Guidelines from Department of Energy Order 5400.5 - WAH-064-98, March 10, 1998), the associated volume is considered radiologically contaminated.
- If any radiological sample measurement (or disposal unit volume) exceeds 100 nanocuries per gram of transuranic material, the associated volume is considered transuranic (TRU) waste.

### **Hazardous Waste**

If decommissioning waste is mixed with or contains a listed hazardous waste, or if the waste exhibits a characteristic of a hazardous waste, then the waste is considered RCRA-regulated hazardous waste in accordance with 6 CCR 1007-3, Parts 261 and 268.

## **Hazardous Substances**

If material contains a listed hazardous substance above a decision document action level and/or the CERCLA reportable quantity (40 CFR 302.4), the material is subject to CERCLA regulation (i.e., remediation and/or notification requirements).

### **Beryllium**

If surface concentrations of beryllium are equal to or greater than  $0.2 \mu\text{g}/100 \text{ cm}^2$ , the material is considered beryllium contaminated per 10 CFR 850.

### **PCBs**

- If material contains PCBs from the manufacturing process at concentrations  $\geq 50$  ppm, the material is considered PCB Bulk Product Waste and subject to the requirements of 40 CFR 761.
- If PCB contamination from a past spill/release is suspected, or if a PCB spill is discovered that has not been cleaned up, the associated material is considered PCB Remediation Waste and subject to the requirements of 40 CFR 761. PCB remediation waste includes: materials disposed of prior to April 18, 1978, that are currently at concentrations  $\geq 50$  ppm PCBs, regardless of the concentration of the original spill; materials which are currently at any volume or concentration where the original source was  $\geq 500$  ppm PCBs beginning on April 18, 1978, or  $\geq 50$  ppm PCBs beginning on July 2, 1979; and materials which are currently at any concentration if the PCBs are spilled or released from a source not authorized for use under 40 CFR 761.
- If a waste or item contains PCBs in regulated concentrations, the waste or item is classified as PCB-regulated material and subject to the requirements of 40 CFR 761.

### **Asbestos**

If any one sample of a sample set representing a homogeneous medium results in a positive detection (i.e.,  $>1\%$  by volume), then material is considered ACM (40 CFR 763 and 5 CCR 1001-10).

### **Tolerable Limits on Decision Errors**

Acceptable false positive and false negative errors for calculating the number of samples required for chemical characterization range from 1% to 10%, unless superceding regulations dictate otherwise. No statistically based sample sets are

required for radionuclides; therefore, decision errors do not apply. Decision error does not apply to asbestos sample sets per 40 CFR 763. Results are compared with the action levels on a sample-by-sample basis.

### Optimization of Plan Design

Discretionary radiological surveying, scanning and sampling will be conducted on remaining floors, walls and ceilings as necessary to classify floors, walls and ceiling as radiologically or not radiologically contaminated for subsequent design of the PDS. The following criteria **SHALL** be used in developing IPC characterization packages:

- Radiological field measurement methods and instrumentation are described in Section 6 of MARSSIM.
- Radiological sampling and preparation for laboratory measurements are described in Section 7 of MARSSIM.
- For materials, media, equipment, floors, walls, and ceilings being released as low level and/or TRU waste, radiological surveys/samples **SHALL** be taken per Site Procedure 1-PRO-079-WGI-001, Waste Characterization, Generation and Packaging.
- If radiological surveys/scans/samples are required for materials, media and equipment for release as non-radioactive waste, then radiological surveying, scanning, and sampling should be conducted per the requirement in the RFETS HSP 18.10, Radioactive Material Transfer and Unrestricted Release of Property and Waste.
- If RCRA, TSCA, Be or asbestos survey/samples are required for materials, media, equipment, floors, walls and ceilings, refer to Section 6.0 of this Protocol.

## **Appendix D**

### **Reconnaissance Level Characterization Plan for D&D Facilities**